

# Logic in Computer Science (CS F214)

## Assignment-2

### General Instructions:

- Please refer to the links provided on the second last slide of the PPT shared on CMS.
- The questions would be the same in the lab exam but you should check your program for other test cases too.
- For questions 10 and 11 you must practice other queries too (apart from the given queries).

1. Create a program that determines whether a provided list is a palindrome without utilizing any built-in reverse functions.

**Input:** ?-is\_palindrome([r,a,c,e,c,a,r]).

**Output:** true

2. Develop a program that groups consecutive duplicate elements in a list and encodes them as pairs [Q, A], where Q represents the number of duplicates of element A.

**Input:** ?- encode([a,a,a,b,c,c,a,a,d],X).

**Output:** X = [[3,a],[1,b],[2,c],[2,a],[1,d]]

3. Create a program to determine whether two given integers are relatively prime.

**Input:** ?-coprime(16,64).

**Output:** false

4. Compose a program to verify if a given term represents a binary tree. Format of the tree is t(root, left, right).

**Input:** ?- istree(t(a,t(b,nil,nil))).

**Output:** false

5. Write a program to convert integer numbers into their equivalent full-word representations.

**Input:** ?- full\_words(172).

**Output:** One-seven-two.

6. Create a program that generates all possible completely balanced binary trees with a specified number of nodes. In such trees, the difference in the number of nodes between the left and right subtrees of any node is at most one.

**Input:** ?- cbal\_tree(3,T).

**Output:** T = t(x,t(x,nil,nil),t(x,nil,nil)).

7. Create a program that divides a list into two parts, where the length of the first part is specified.

**Input:** ?- split([a,b,c,d,e,f,g,h,i,k],10,L1,L2).

**Output:** L1 = [a,b,c,d,e,f,g,h,i,k]

L2 = []

8. Create a program to find the prime factors of a given positive integer.

**Input:** ?- prime\_factors(95, L).

**Output:** [5,19].

9. Write a program to check if a given integer is a prime number.

**Input:** ?- is\_prime(2165987).

**Output:** False.

10. Create a database on the following facts and write the queries for the given questions.

Property
Property1
Property2
Property3
Property4
Property5
Property6
Property7

Tenants
John
Mary
David
Lisa

Occupancy	
Property1	John
Property2	Mary
Property4	David
Property6	Lisa

Property Type	
Property1	Apartment
Property2	Apartment
Property3	Apartment
Property4	House
Property5	House
Property6	Office
Property7	Office

Monthly Rent	
Property1	1200
Property2	1100
Property4	2000
Property6	1500

Maintenance Cost	
Property1	100
Property2	120
Property4	150
Property6	200

Create the database as follows:

Property(X) => X is a property

Tenant(Y) => Y is a tenant

Occupied(X, Y) => X is occupied by Y

Property\_Type(X, A) => X is a property of type A

Rent(X, B) => Property X has rent \$B

Maintenance\_cost(X, C) => Property X has maintenance \$C

### QUERIES :

- a) List all properties and their types.

**Output:** Property = Property1, Type = apartment ;  
Property = Property2, Type = apartment ;  
Property = Property3, Type = apartment ;  
Property = Property4, Type = house ;  
Property = Property5, Type = house ;  
Property = Property6, Type = office ;  
Property = Property7, Type = office ;

- b) List all properties and their monthly rents.

**Output:** Property = Property1, Rent = 1200 ;  
Property = Property2, Rent = 1100 ;  
Property = Property4, Rent = 2000 ;  
Property = Property6, Rent = 1500 ;

- c) List all tenants and the properties they occupy.

**Output:** Property = Property1, Tenant = john ;  
Property = Property2, Tenant = mary ;  
Property = Property4, Tenant = david ;  
Property = Property6, Tenant = lisa ;

- d) List properties with their types and rents that have a maintenance cost below 130.

**Output:** Property = apartment1, Cost = 100, Type = apartment, Rent = 1200 ;  
Property = apartment2, Cost = 120, Type = apartment, Rent = 1100 ;

11. In a university, there are several courses and students. Each student can enroll in multiple courses, and some students may choose the same courses. Create a database that tracks the courses and students, their enrolment in specific courses, and professors teaching those courses from the data given below. On that database write query for the given questions.

Student
alice
bob
charlie
emily
david

Courses
mathematics
computer_science
economics
literature
physics

Professor	Course
dr_davis	mathematics
dr_smith	computer_science
dr_jones	economics
dr_mrunal	literature
dr_kavita	physics

	Math	CS	Economics	Literature	Physics
<b>alice</b>	Yes	Yes	No	Yes	No
<b>bob</b>	Yes	No	No	No	Yes
<b>charlie</b>	No	No	No	Yes	Yes
<b>emily</b>	Yes	Yes	No	No	No
<b>david</b>	No	Yes	No	Yes	No

Create the database as following:

course(X) => X is a course.

student(Y) => Y is a student.

enrolled(Y, X) => Y is enrolled in course X.

professor(Z, X) => Z is professor of course X.

You are also required to add a rule in the database study\_partner(Y1, Y2) which means that Y1 and Y2 are study partners for a course and  $Y1 \neq Y2$ .

### QUERIES:

- a) Find all courses with no enrolled students.  
**Output:** Course: economics
- b) List all students who are enrolled in computer science course taught by Professor dr\_smith.  
**Output:** Student: alice  
Student: emily  
Student: david
- c) Find students who are enrolled in both Mathematics and Physics.  
**Output:** Student: bob